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LMSD 1536 Vol. II
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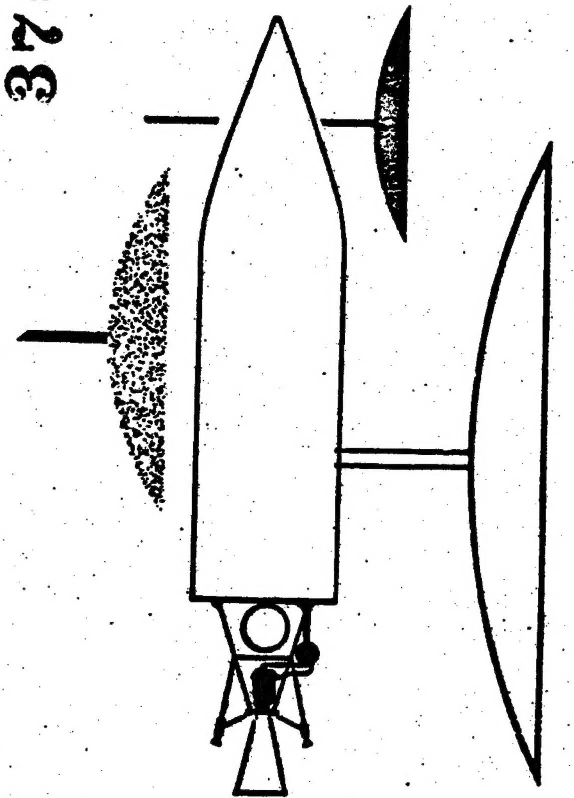

Pied Piper
DEVELOPMENT PLAN (S)

VOL. II SUB-SYSTEM PLAN

G. Infrared Reconnaissance

3 0 1968

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NO 61219

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LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION
VAN NUYS, CALIFORNIA

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SECURITY CLASSIFICATION

MSD 1536

RDB PROJECT CARD	TYPE OF REPORT	REPORTS CONTROL SYMBOL DD-RDB(A)68

1. PROJECT TITLE
INFRARED RECONNAISSANCE SUBSYSTEM
FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl.)

(PIED PIPER)

2. SECURITY: ~~Secret~~

3. PROJECT NUMBER: 1115

4. INDEX NUMBER:

5. REPORT DATE: 1 March 1956

6. BASIC FIELD OR SUBJECT:

7. SUBFIELD OR SUBJECT SUBGROUP:

7A. TECH. OBJ.:

8. COGNIZANT AGENCY:

9. DIRECTING AGENCY:

OFFICE SYMBOL:

TELEPHONE NO.:

10. REQUESTING AGENCY:

11. PARTICIPATION, COORDINATION, INTEREST:

12. CONTRACTOR AND/OR LABORATORY
Lockheed Missile
Systems Division

CONTRACT/W.O. NO.: AF 33(616)-3105

13. RELATED PROJECTS:

14. DATE APPROVED:

15. PRIORITY: Maximum

16.

17. EST. COMPL. DATES

RES.	
DEV.	
TEST	
OP. EVAL.	

18. FY	FISCAL ESTS. (M $)

19.

20. REQUIREMENT AND/OR JUSTIFICATION

a. This subsystem will provide early warning, observation of military aircraft patterns, and ground detection of targets. No comparable subsystem is currently available or under development. All previous infrared systems have been developed for manned aircraft. For satellite application, the resolution, sensitivity, scanning, and data processing requirements are of different magnitudes because of the altitude and environment (nuclear radiation from the APU for example). Extremely high reliability is required for unmanned operation, and other operational considerations.

b. Air Force interest will center about surveillance possibilities, particularly of inaccessible regions as related to early warning systems.

c. This subsystem should increase Air Force capability in the direction of greatly increased warning time of attack by manned aircraft, air-breathing missiles, and ICBM launchings. It will also increase the Air Force capability to provide surveillance of military air traffic patterns as an indicator of imminence of hostilities.

22. RDB	SN	CN	SC & P	X.	L.	C.

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MISSILE SYSTEMS DIVISION

~~SECRET~~
SECURITY CLASSIFICATION

G, p 1
LOCKHEED AIRCRAFT CORPORATION

R&D PROJECT CARD CONTINUATION SHEET

SECURITY CLASSIFICATION ~~SECRET~~

1. PROJECT TITLE INFRARED RECONNAISSANCE SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (UNCLASSIFIED) (PIED PIPER)	2. SECURITY OF PROJECT ~~Secret~~	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

21 a. Characteristics

This subsystem will acquire infrared radiation data for the tracking of manned bombers and air-breathing missiles. It will include equipment for information storage and relay to ground intercept stations. Variants will provide for detecting and tracking of ICBMs, for instantaneous data transmission through a multi-satellite communication network. Reconnaissance and surveillance data is thus delivered for intelligence groups.

21 b. Approach

Two models of infrared equipment employing detectors of the PbTe type are considered: one for operations against manned bombers and air-breathing missiles and the other against ICBMs. Although the basic concepts will be the same for both, there are two major differences: the type of scan and method of transmitting the data to the ground. For ICBM detection-tracking the information is relayed to the ground via an intersatellite radio network, and a satellite-to-ground link. In the case of the manned bomber detection system, the information is recorded prior to transmission to the ground. The type and quantity of information that is transmitted and recorded is such as to permit the use of very narrow bandwidths (on the order of kilocycles). Sensitivity, resolution, and reliability will be the major problems which will be encountered during the subsystem development program.

21 c. Subsystems Tasks

1. a. IR Scanner for Bomber Tracking

b. Contractor: Eastman Kodak Co., and Lockheed, MSD.

c. The optical system for the manned bomber and the air-breathing missile will be designed in accordance with conventional infrared collector systems. The reflector will be capable of scanning around a vertical axis covering a solid angle of 90 degrees, making it possible to determine orientation of the target with respect to the satellite. The subsystem will be capable of detecting the exhaust plumes of manned aircraft as well as air-breathing missiles in the radiation region of 4.2 microns. The range of detection of a high-altitude intercontinental bomber or missile will be in the order of 420 n. miles. (Ref. 1, p. A-1)

R&D PROJECT CARD
CONTINUATION SHEET

1. PROJECT TITLE INFRARED RECONNAISSANCE SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl.) (PIED PIPER)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

2. a. IR Scanner for ICBM Tracking

   b. Contractor: Eastman Kodak Co., and Lockheed, MSD.

   c. The optical system to be utilized for the ICBM detection will be similar in general features to those used for bomber detection. However, due to the nature of the detection problem (high trajectory ballistic missiles) it will be necessary to provide two reflectors mounted back-to-back creating two essentially horizontal fan beams which scan up and down in a nodding motion. The detection range of the system will be a minimum of 3000 n. miles against ICBMs. The altitude of operation of the satellites is in the order of 1000 n. miles. (Ref. 1, p A-13)

3. a. Airborne Data Processing

   b. Contractor: CBS and Lockheed, MSD.

   c. The detected electronic information as received by the scanner which was described in task 1 above is appropriately processed by means of a data processing coder in a form suitable for recording. This data processing equipment will be very similar to that being developed for the Electronic Reconnaissance subsystem.

4. a. Data Recording

   b. Contractor: CBS and Lockheed, MSD.

   c. The data as received from the data processing unit of task 3, is stored on a suitable narrow band magnetic tape recorder. The recording equipment will be quite similar to that being developed for the Electronic Reconnaissance subsystem.

5. a. Data Transmission

   b. Contractor: CBS and Lockheed, MSD.

   c. The data as recorded for subsequent transmission (task 4) provides the input to the data transmission equipment. This equipment consists of a transmitter and associated equipment and will be similar to equipment being developed for the Electronic Reconnaissance subsystem.

R&D PROJECT CARD
CONTINUATION SHEET

SECRET
SECURITY CLASSIFICATION

1. PROJECT TITLE INFRARED RECONNAISSANCE SUBSYSTEM FOR ADVANCED RECONNAISSANCE SYSTEM (Uncl.) (PIED PIPER)	2. SECURITY OF PROJECT Secret	3. PROJECT NUMBER 1115
	4.	5. REPORT DATE 1 March 1956

6. a. **Data Link Network for ICBM Tracking**

b. Contractor: CBS and Lockheed, MSD.

c. To provide for immediate transmission of ICBM track data, an inter-satellite network is required. This network is composed of an omnidirectional transmitter and receiver in each satellite. This equipment will not impose a serious weight problem. As targets are detected, the inter-satellite network is activated and all pertinent information is instantaneously put into the network. The number of satellites in this system is chosen such that detection requirements as well as inter-satellite network requirements are met. (Ref. 1, p A-13)

21 d. **Other Information**

Design techniques as developed by other companies in the I-R field will be monitored in order to assure the completion of a satisfactory subsystem in time for the planned system. There is no available adequate equipment.

21 e. **Background History**

Study contracts such as Pied Piper under AF 33(616)-3105 have determined that reconnaissance data to be obtained with a satellite can be obtained in no other way. Study has determined that important data could be obtained by an Infra red Satellite Reconnaissance System.

21 f. **Future Plans**

It is planned to continue the studies already initiated and to develop equipment suitable for testing.

21 g. **References**

1. 2d Quarterly Report, Project Pied Piper.

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Pied Piper

MSD 1536

LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION

TABS

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Subsystem G - INFRARED RECONNAISSANCE

Tab 1 - General Design Specifications

I. GENERAL

A. Statement of the Problem

The basic objective in this subsystem is the solution of the problem of detecting and monitoring infrared images of minute size relative to the large field of view involved. Another aspect of the problem involves the urgency of extracting the data for immediate conversion to military usefulness in counter force activities and to preserve it for use in military intelligence. As in the case of the visual reconnaissance subsystem, the problem is further complicated by the satellite's orbital altitude and velocity.

B. Approach

The approach which will be followed in solving the problem of developing the infrared subsystem is as follows: Two models of infrared equipment, employing detectors of the PbTe type are considered, one for operation against manned bombers and air breathing missiles and the other against ICBM's. Although the basic concepts will be the same for both, there are two major differences, namely, the type of scan and, in the case of the ICBM detection tracking system, the information being relayed to the ground via an intersatellite radio network and satellite-to-ground link. In the case of the manned bomber detection system, the information is recorded prior to transmission to the ground. The type and quantity of information that is transmitted and recorded is such as to permit the use of very narrow bandwidths (on the order of kilocycles per second). The specific equipment to be developed is described in Sec. 2.

C. Solution

Tentative measurements on the infrared radiation emanating from high thrust rocket engines have indicated the feasibility for detecting and tracking aircraft and ICBM's from satellites. However, it will be necessary to carry out a continuing research and testing program aimed at determining radiation values from rocket engines, sensitivity required of infrared detector cells, and means of increasing their capabilities.

Simultaneous with the research program will be the preparation of the design specifications for the first experimental laboratory model of infrared scanner. This will be followed by design, fabrication and testing of environmental components for flight test, an aircraft test model, a payload test vehicle model and later, an operational test vehicle model of the overall subsystem equipment.

The elements of the infrared air surveillance subsystem for the satellite are all within the state-of-art and can be developed with a normal amount of effort. It is anticipated that the major problems which will be encountered in obtaining an operational infrared subsystem will be those associated with achieving required sensitivity and resolution of the optical system. Another major problem which must be faced will be that of achieving a satisfactory reliability for an automatic unattended system operating in the extreme environment which will exist in a satellite (nuclear radiation fields due to A.P.U., extreme variations in temperatures, etc.).

One of the most difficult problems will be that of providing near 100% reliability during the required military useful life. One specific example is the problem of operating the infrared scanner in the extreme temperature environment and low pressures. This is considered to be primarily a design problem in materials, bearing seals, etc. Shielding design requirements, due to nuclear radiation fields, must be determined in order to prevent deleterious effects on the operation of the PbTe infrared cells, if in fact such effects exist. Ground and flight tests will be required over long periods of time to determine the cumulative effects of these radiation fields.

Information must be derived concerning the spatial and spectral characteristics of rocket engines at various altitudes and using various fuel combinations. It is planned to carry out these tests on test missiles currently in the overall ICBM program. Radiation measurements from the exhaust of turbojets in the region of 4.2 microns will be obtained from current programs.

As a part of the development program it will be necessary to design and fabricate models of experimental laboratory equipment. This equipment will be given extensive laboratory tests to determine feasibility of the concepts and to determine performance parameters primarily of the optical portion of the system.

It is planned to carry out high altitude aircraft tests with the first development model of the infrared subsystem. This development model of the infrared equipment will be modified from the satellite configuration by scaling down and calibrating the major components in order to simulate the operation from a satellite. Other laboratory bench models will also be fabricated.

Simultaneous with the aircraft flight test program, critical components of the complete subsystem will be fabricated for testing in the systems test vehicle flight program. These tests will provide certain environmental conditions for components such as infrared detectors, scanner bearings, amplifiers, instrumentation, etc.

The next step is the design and fabrication of several models of the complete IR equipment including all components to be utilized in complete subsystem tests in the Payload Test Vehicle (PTV). These tests will allow the first opportunity to carry out development tests of the equipment in the full scale orbiting vehicle. There will be two variations of the equipment for the first time which will allow tracking of both manned aircraft, and air breathing missiles as well as the ICBM's.

The series of models for complete infrared tracking equipment will be flight tested in the Operations Test Vehicle (OTV). Here there will be six complete subsystems fabricated for each mission; i.e., manned bomber tracking and ICBM tracking. These flight tests will provide the final checks on complete systems performance under operational satellite conditions. It is planned in the case of the ICBM tracking equipment to test out the inter-satellite communications network through the use of two satellites in orbit simultaneously.

In the case of the airborne data processing, recording and transmission equipment, it is intended to take full advantage of the development program which will exist as a part of the Electronic Reconnaissance Subsystem. For this purpose, specifications for these equipments will be prepared based upon the electronic reconnaissance development program and incorporating the minimum number of changes as necessary to fulfil special requirements of the infrared subsystem.

There are no components in the subsystem which are inherently unreliable except for some portions of the electronic circuitry. The electronic unreliability will be treated by the use of redundancy of components and good circuit design.

There are no special installation considerations necessary in connection with the infrared subsystem except for the removable nose cone.

No major GFE is required.

G-Tab 1, p 3

II. DESCRIPTION OF SUBSYSTEM TASKS

A. IR Scanner for Bomber Tracking

The optical system for the manned bomber and air breathing missile will be designed in accordance with conventional infrared collector systems. The following represents a general guide to how the problem amy be solved. The collector would consist of a line array of 40 cooled PbTe detecting cells contained at the focal plane of a 56 in. diameter reflector. Each element would cover a 1° elemental field of view. The reflector would be capable of scanning around a vertical axis and thus cover a solid angle of 90° in 40 concentric 1° circles. The azimuthal orientation of the optical system would be determined and by electronically scanning each individual detecting element in the line array, it would be possible to determine the orientation of the target with respect to the satellite. The detecting elements are capable of detecting the exhaust plumes of manned aircraft as well as air breathing missiles in the radiation region of 4.2 microns. The range of detection on a high altitude intercontinental bomber or missile shall not be less than 420 n. miles. A typical installation of this type of equipment in an orbiting vehicle is shown in Fig. 1. Additional information concerning the operational and hardware studies which support the proposed solution to this task appears in the second quarterly report, MSD-1481, pages 8, 17 and 41.

B. IR Scanner for ICBM Tracking

The optical system to be utilized for the ICBM detection would be similar in general features to that for the detection of manned bombers. However, due to the nature of the detection problem (high trajectory ballistic missiles) it will be necessary to provide two reflectors mounted back-to-back which create two essentially horizontal fan beams which scan up and down in a nodding motion. The optical system would consist of upwards of 70 cooled PbTe detecting elements arranged in a line array at the focal plane of a 56 in. reflector. The incremental field of view will be in order of 0.25° and the overall detection cone will be around 18°. The detection range of the system would be a minimum of 3000 n. miles against ICBM's. The altitude of operation of the satellites is in the order of 1000 n. miles. Additional details covering the operational studies which support the proposed solution of this task appear in report No. MSD-1481, pages 9, 18, and A-13.

C. Airborne Data Processing

The detected electronic information as received by the scanner which was described in para. IIA is appropriately processed by

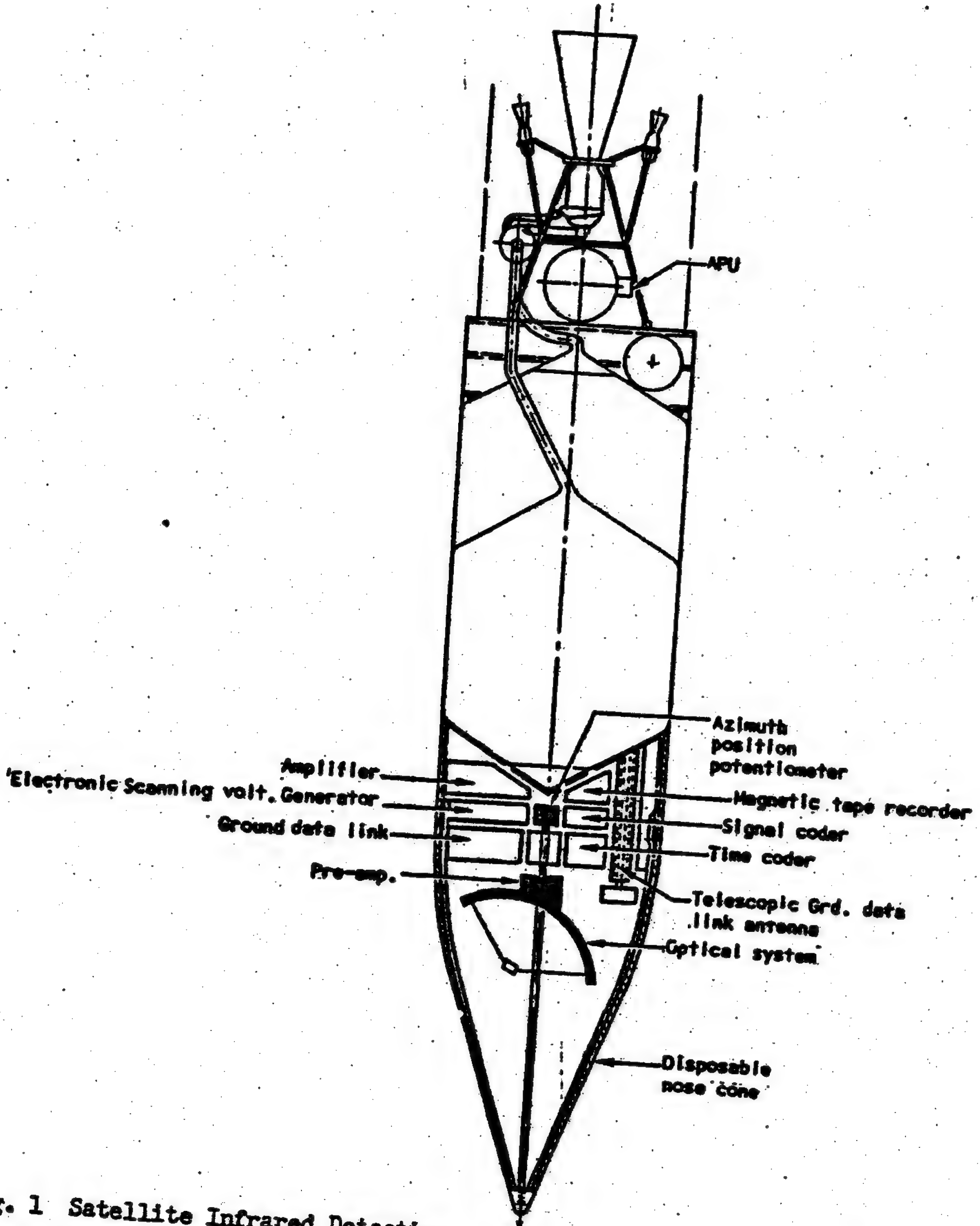


Fig. 1 Satellite Infrared Detection and Surveillance System Installation

means of a data processing coder in a form suitable for recording. This data processing equipment will be similar to that being developed for the Electronic Reconnaissance Subsystem F.

D. Data Recording

The data as received from the data processing unit of para. IIC in this tab is stored on a suitable narrow band magnetic tape recorder. This data recording equipment will be similar to that being developed for the Electronic Reconnaissance Subsystem.

E. Data Transmission

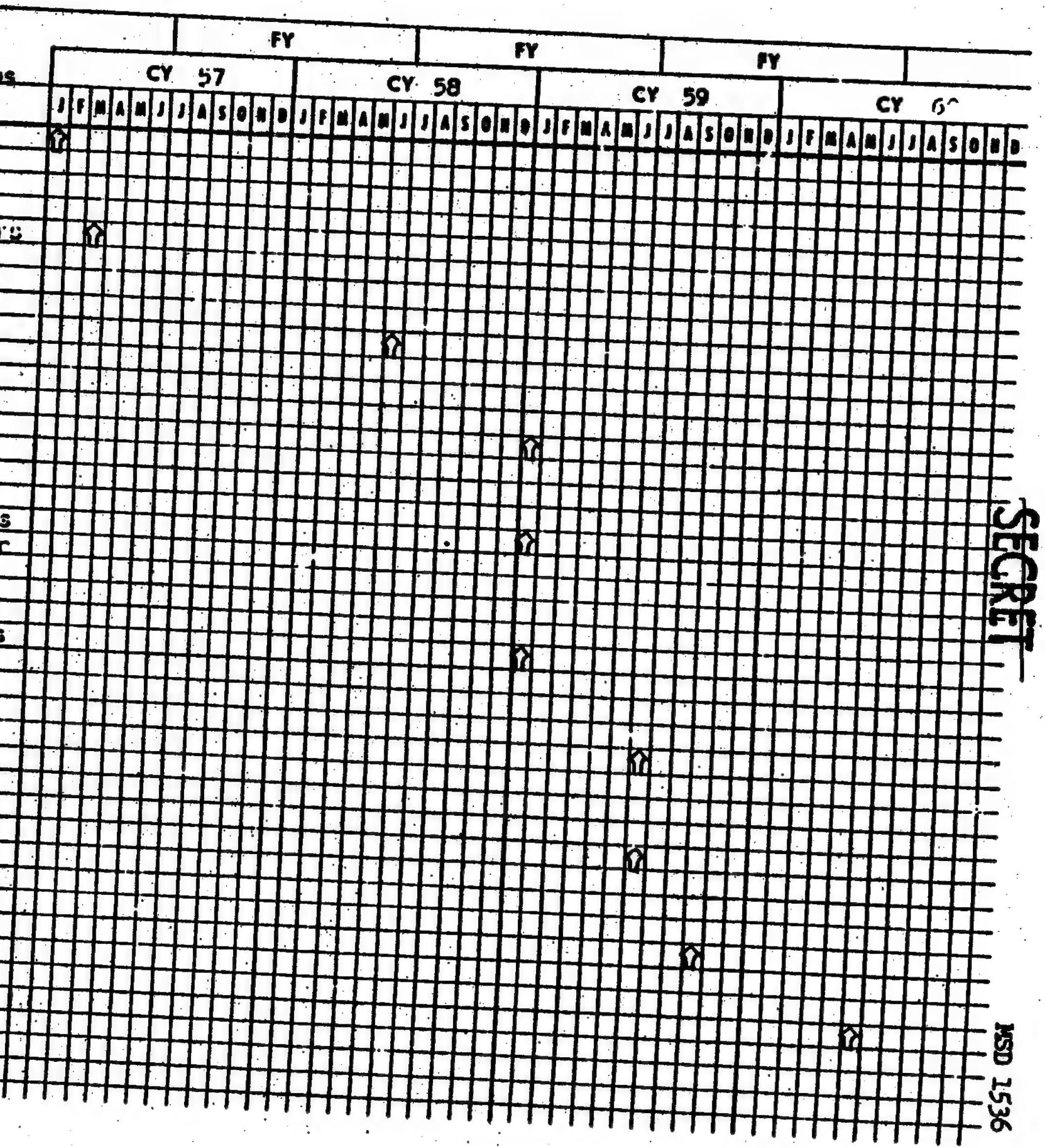
The data as recorded by the data recording equipment described in para. IC of this tab is fed into the data transmission equipment. This equipment consists of a transmitter and associated equipment and will be similar to the equipment being developed for the Electronic Reconnaissance Subsystem.

F. Data Link Network for ICBM Tracking

To provide for immediate transmission of ICBM tracking data, an intersatellite network is required. This network is composed of an omnidirectional transmitter and receiver in each satellite and would operate on a frequency of about 30 mc. in order to minimize the radiation which reaches the ground. As the targets are detected by the optical system, the data is transmitted instantaneously into the intersatellite network. The ground station will be capable of "tapping" off the data from the inter-satellite communication network. This ground to satellite data link will operate in the frequency band of 200-300 mc. Operational considerations which dictate the use of the proposed inter-satellite network are contained in report No. MSD-1481, page A-13.

Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - Subsystem Milestones



Research Program Begins
(continuing study)

Preparation of Design Specifications
for first experimental model

Design and Fabrication of first
experimental laboratory model

Testing of first experimental
laboratory model

Design and fabrication of two models
of PTV (Payload Test Vehicle) for
manned Bomber started

Design and fabrication of two models
of PTV for ICBM started

Design and fabrication of first
aircraft test model

Non-operating Mock-up for PTV
completed

Begin Aircraft Tests

Fabrication of equipment [illegible] [illegible]
for PTV flights

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Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - Subsystem Milestones (Continued)

Begin Production Design and Fabrication of CTV Models

Flight Tests of Environment components in STV

Fabrication of first model of PTV test model completes

Testing of first aircraft test model completed

First PTV Laboratory Test Model completed for Manned Bomber

Flight Test of PTV Models for Manned Bombers

Testing of Second Aircraft Test Model (ICBM)

Second PTV Flight Test Model completes for ICBM

Completion of Fabrication of First OTV model for Manned Bomber

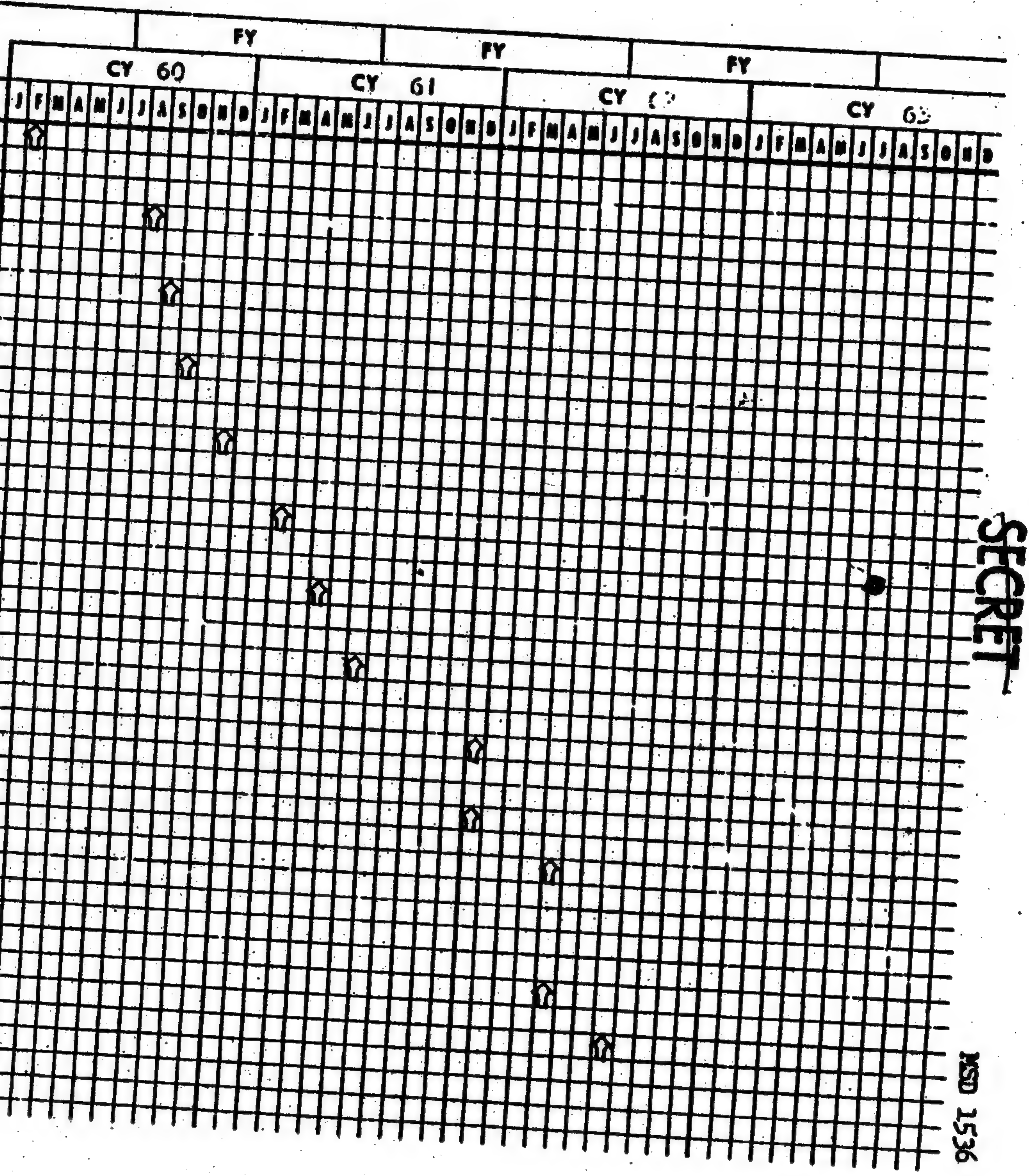
Flight Test of PTV Model for ICBM

Completion of Fabrication of First OTV Model for ICBM

Flight Testing of First OTV Models

First Manned Bomber Model

First ICBM Model



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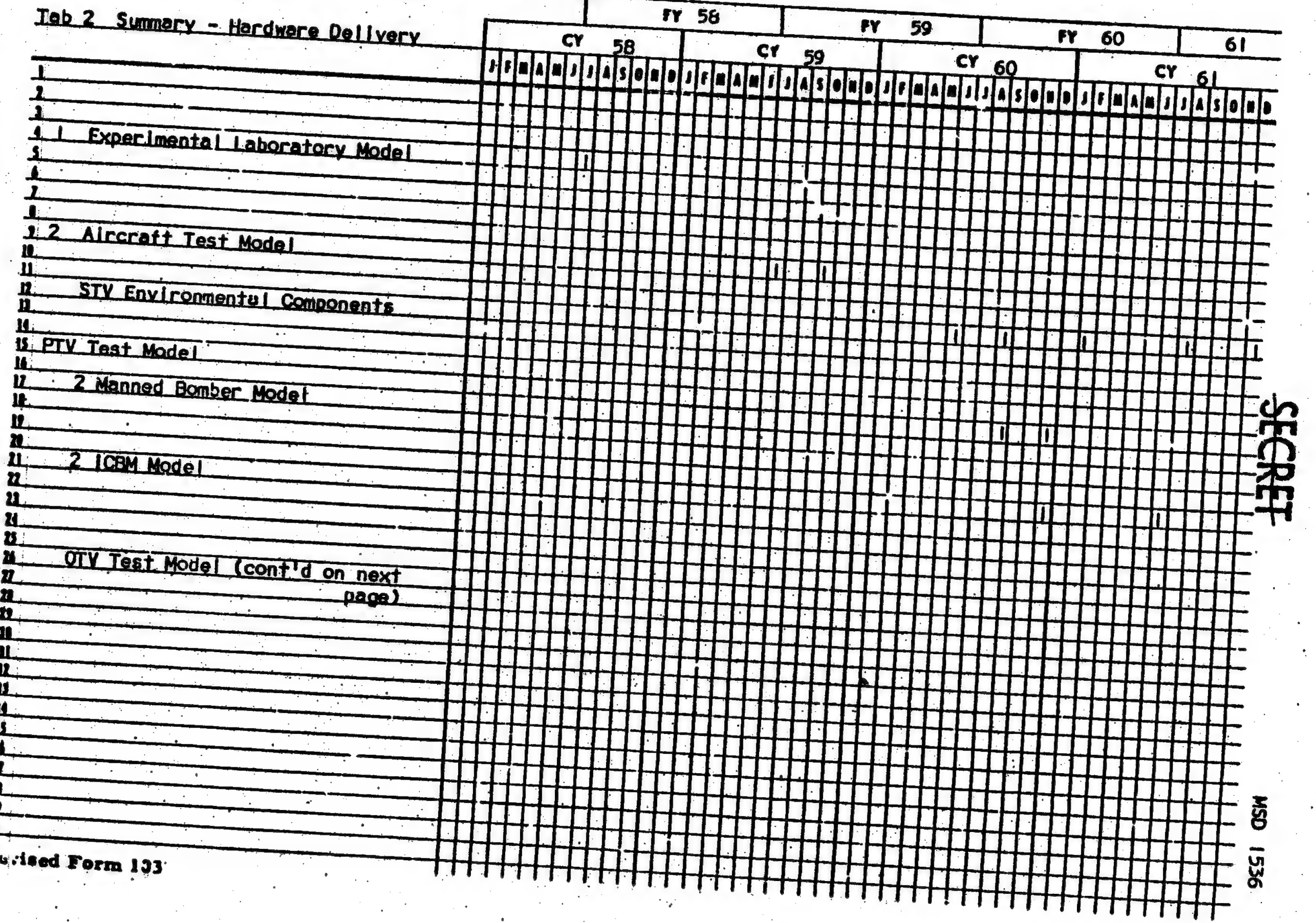
Subsystem G - INFRA RED SYBSYSTEM

Tab 2 Summary - Hardware Delivery



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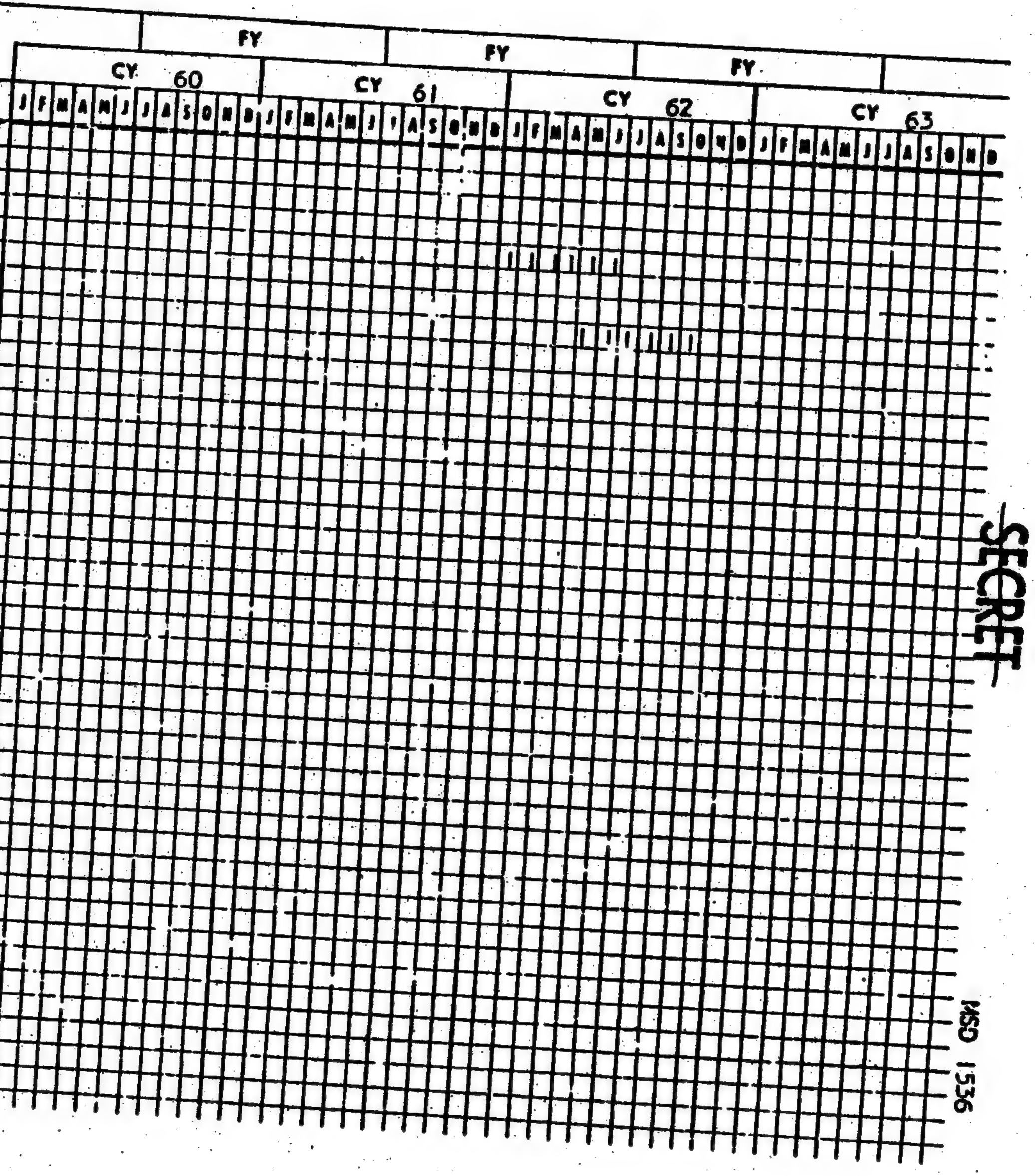
Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - Hardware Delivery (Continued)

OTV Test Model (cont'd)

6 Manned Bomber Models

6 ICBM Models



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Subsystem G - INFRA RED SUBSYSTEM

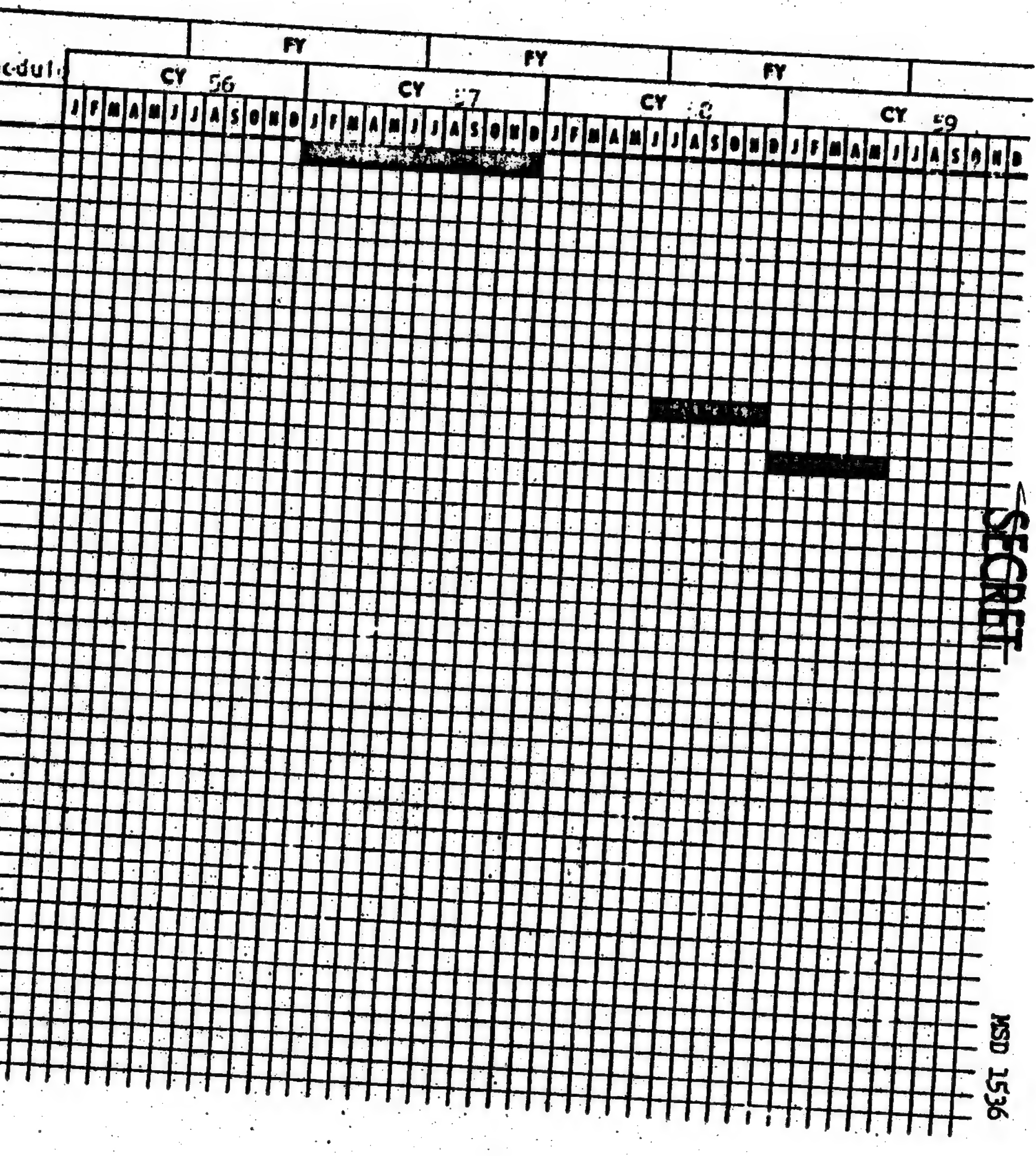
Task 2 Summary - Subsystem Test Schedul

Research Lab. Tests

Experimental Lab. Model

Environment Tests

Laboratory Performance Tests



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MISSILE SYSTEMS DIVISION

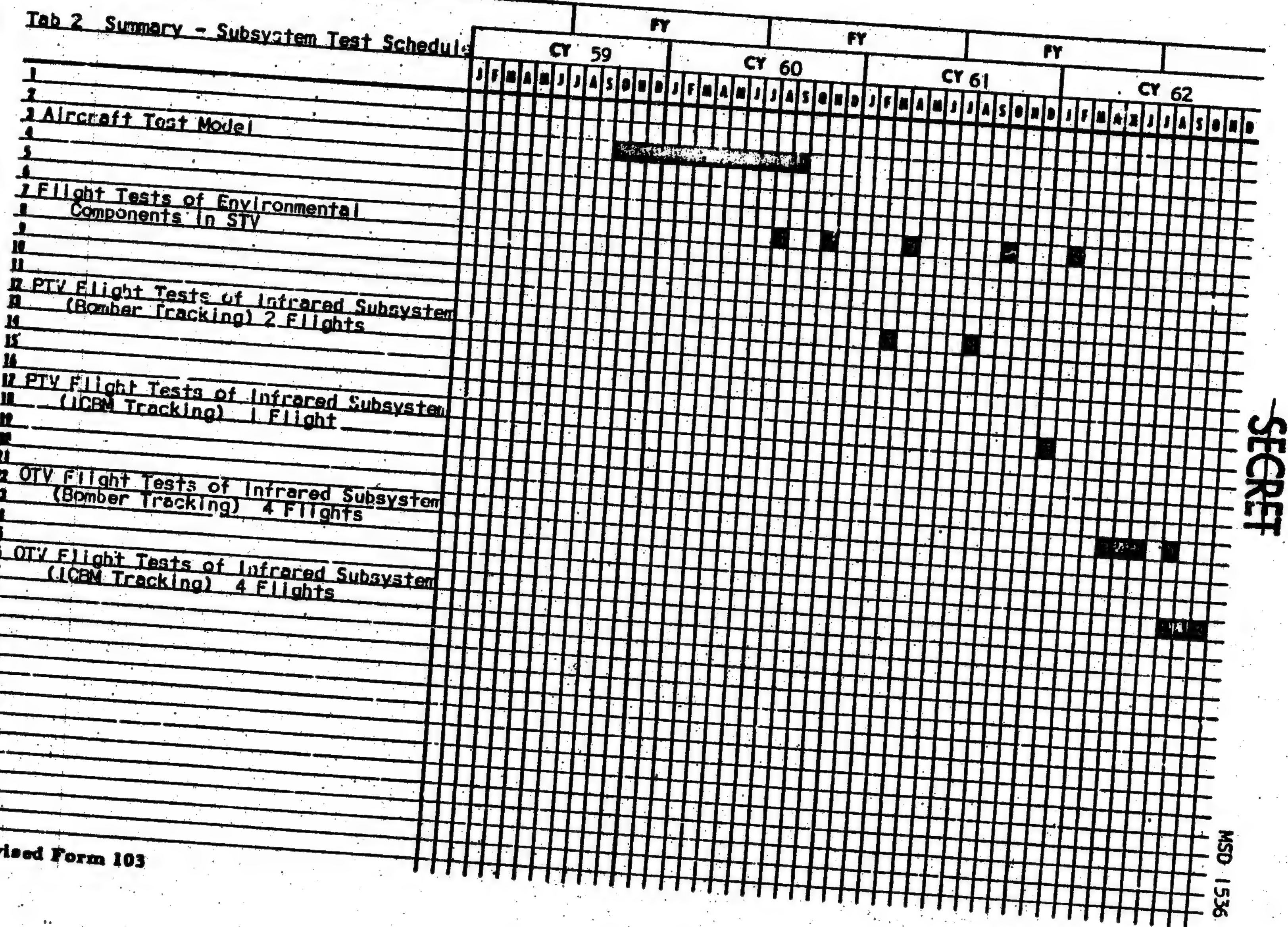
SECRET

LOCKHEED AIRCRAFT CORPORATION

MSD 1536

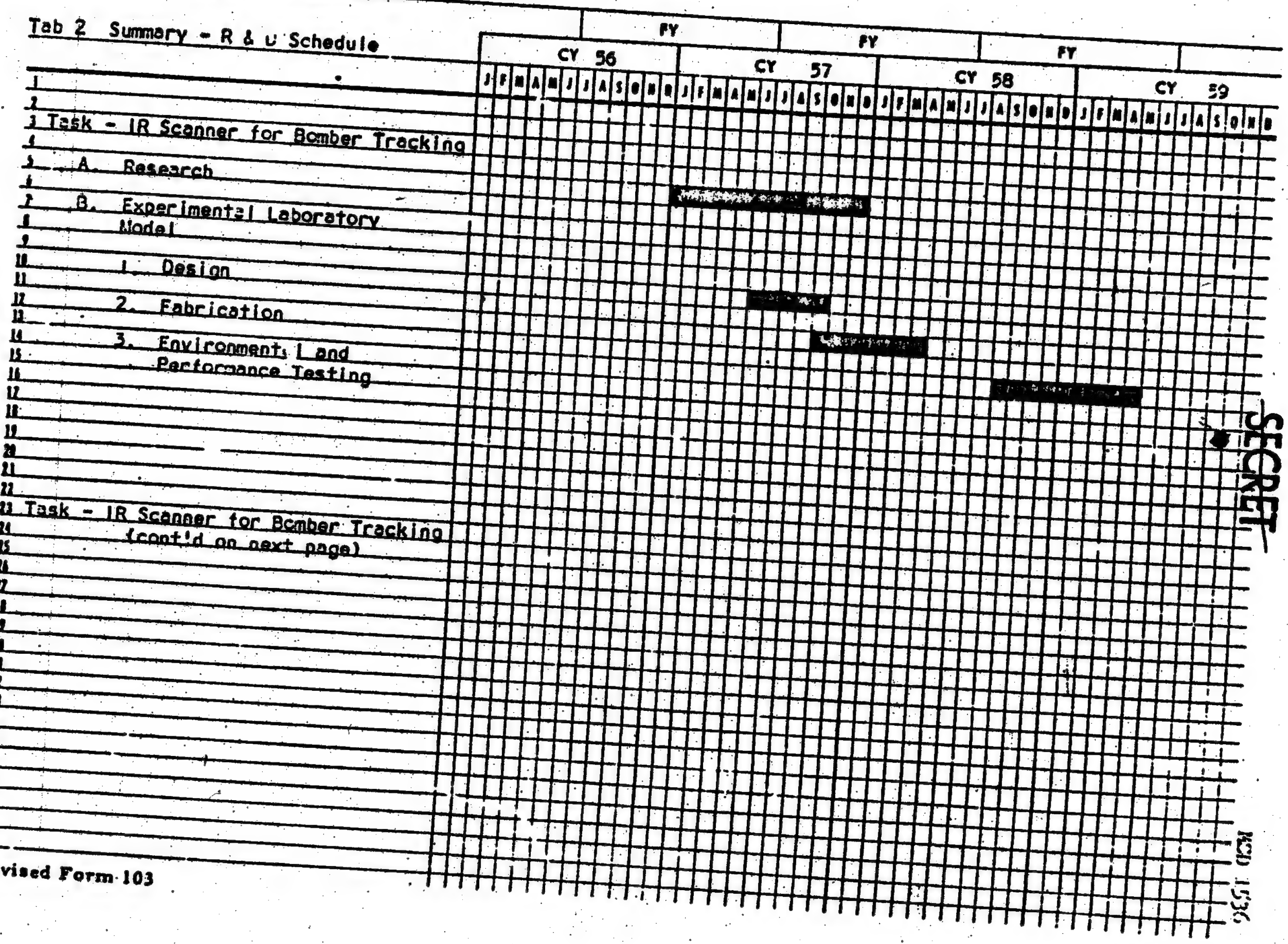
Subsystem G - INFRARED SUBSYSTEM

Tab 2 Summary - Subsystem Test Schedule



Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule



3 Task - IR Scanner for Bomber Tracking

5 A. Research

7 B. Experimental Laboratory
8 Model

10 1. Design

12 2. Fabrication

14 3. Environmental and
15 Performance Testing

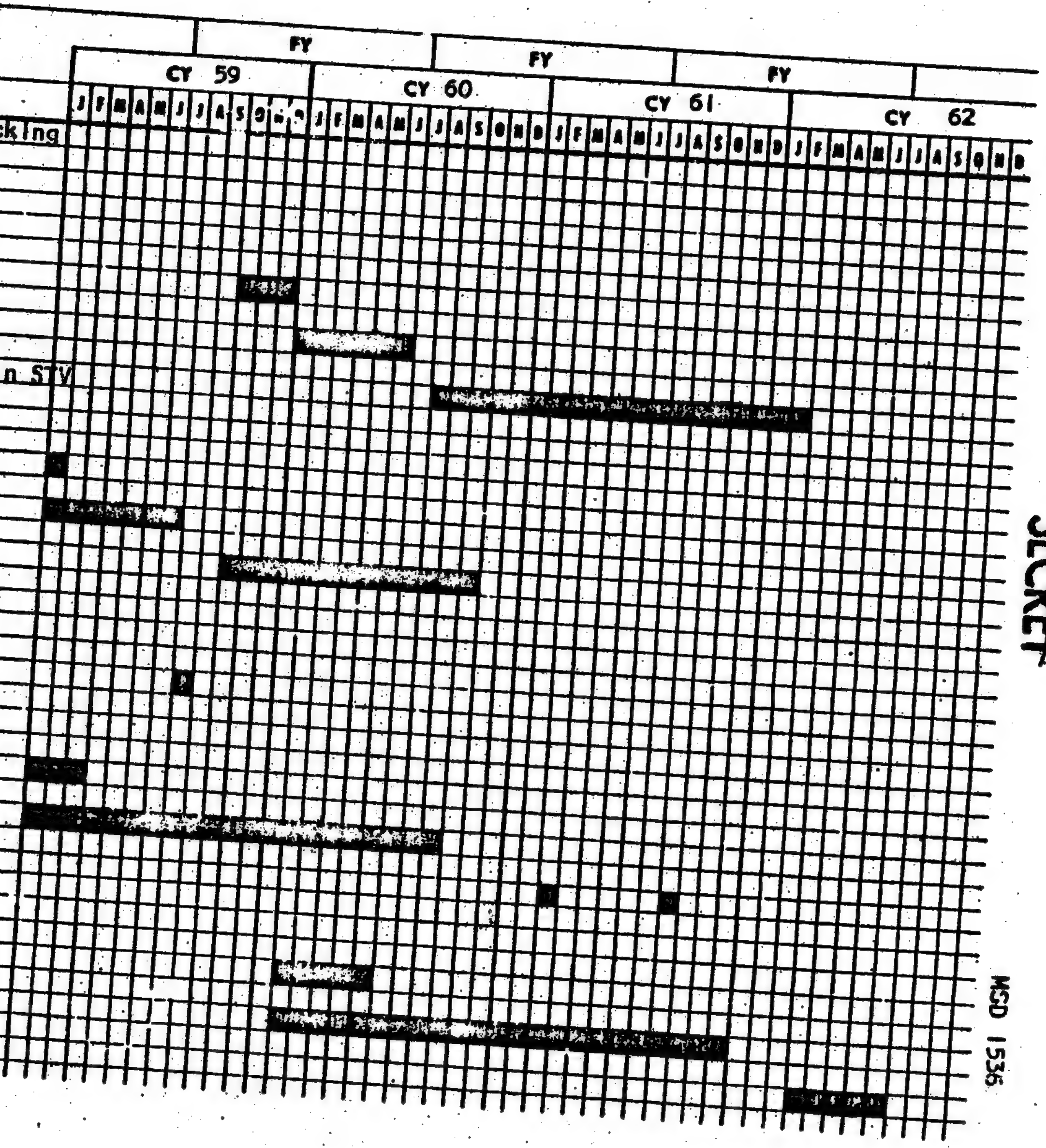
23 Task - IR Scanner for Bomber Tracking
24 (cont'd on next page)

Revised Form 103

Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule
(Continued)

1 Task - IR Scanner for Bomber Tracking
2 (Continued)
3
4
5 C. Environmental Components
6
7 1. Design
8
9 2. Fabrication
10
11 3. Environmental Testing in STV
12
13 D. Aircraft Test Model
14
15 1. Design Completion
16
17 2. Fabrication
18
19 3. Flight Testing
20
21 E. Non Operating Mock Up Model
22 for PTV
23
24 1. Fabrication Completion
25
26 F. PTV Test Model
27
28 1. Design
29
30 2. Fabrication
31
32 3. Flight Testing
33
34 G. UTV Test Model
35
36 1. Design
37
38 2. Fabrication
39
40 3. Flight Testing



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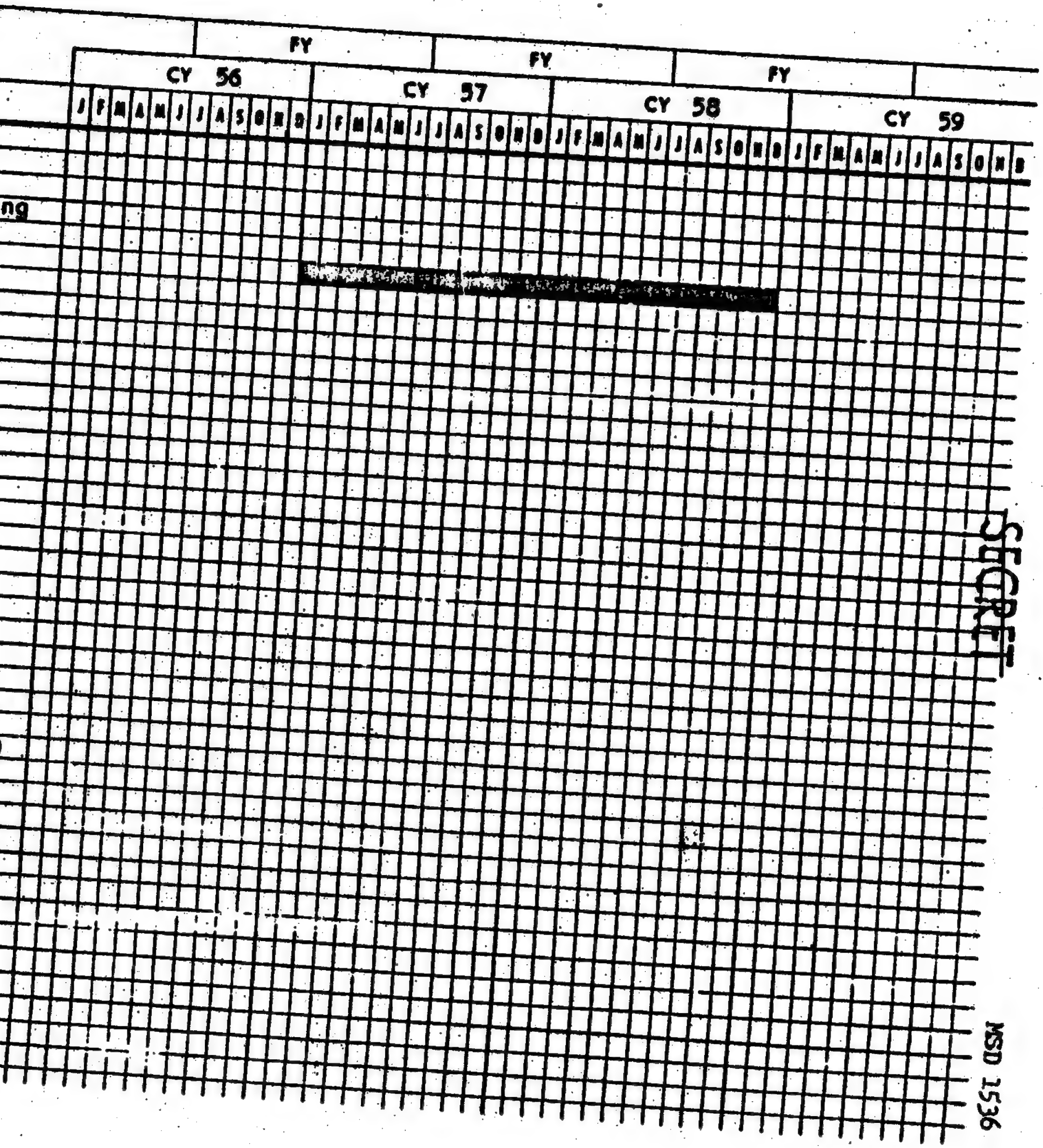
Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule
(Continued)

Task - IR Scanner for ICBM Tracking

A. Research



Task - IR Scanner for ICBM Tracking
(Continued on next page)

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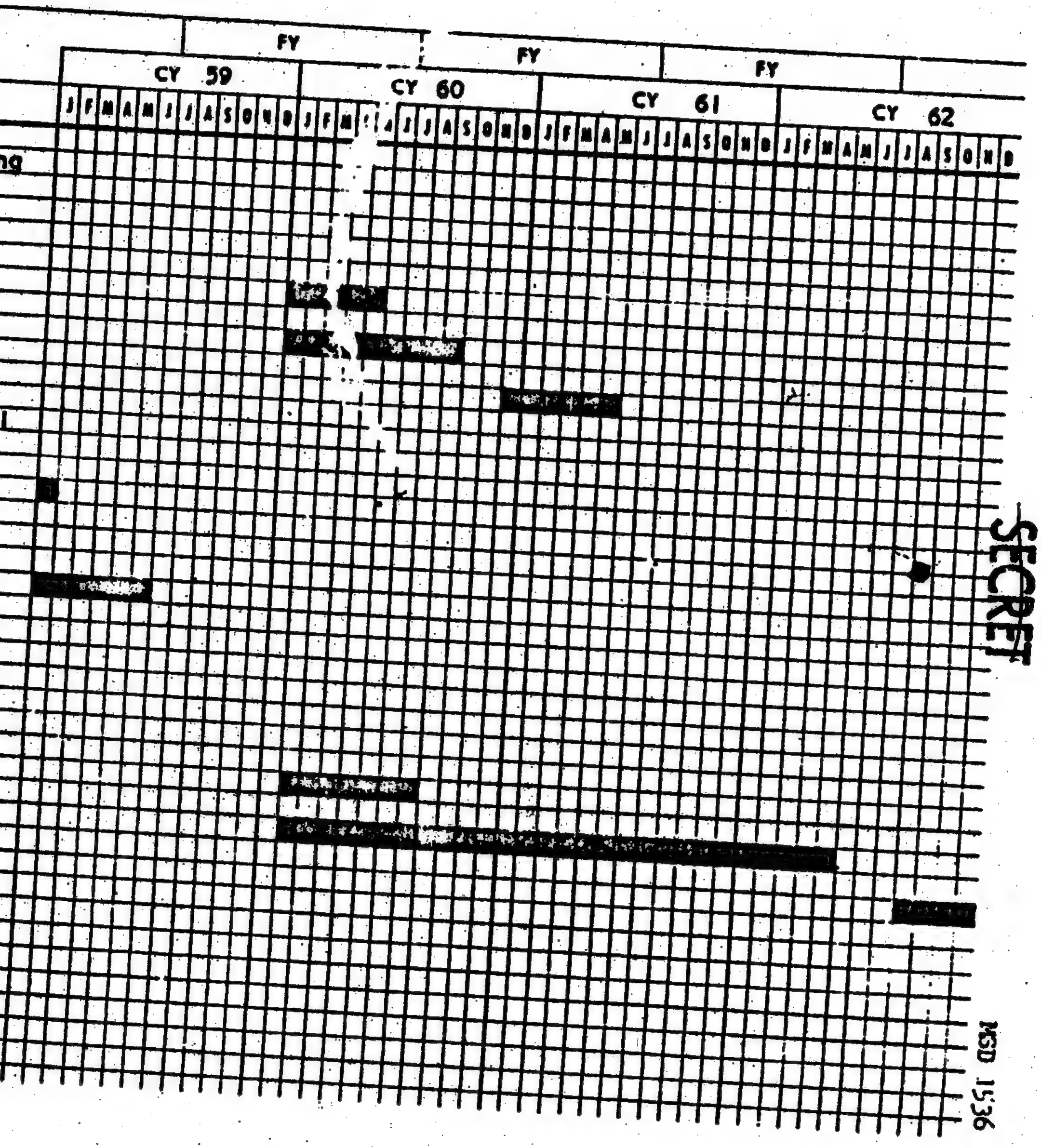
Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule (Continued)

Task - IR Scanner for ICBM Tracking (Continued)

- B. Aircraft Test Model
  - 1. Design Completion
  - 2. Fabrication
  - 3. Testing
- C. Non Operating Mock Up Model for PTV
  - 1. Fabrication Completion
- D. PTV Test Model
  - 1. Design
  - 2. Fabrication Completion
  - 3. Testing Completion
- E. OTV Test Model
  - 1. Design
  - 2. Fabrication
  - 3. Testing



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Subsystem G - INFRA RED SUBSYSTEM

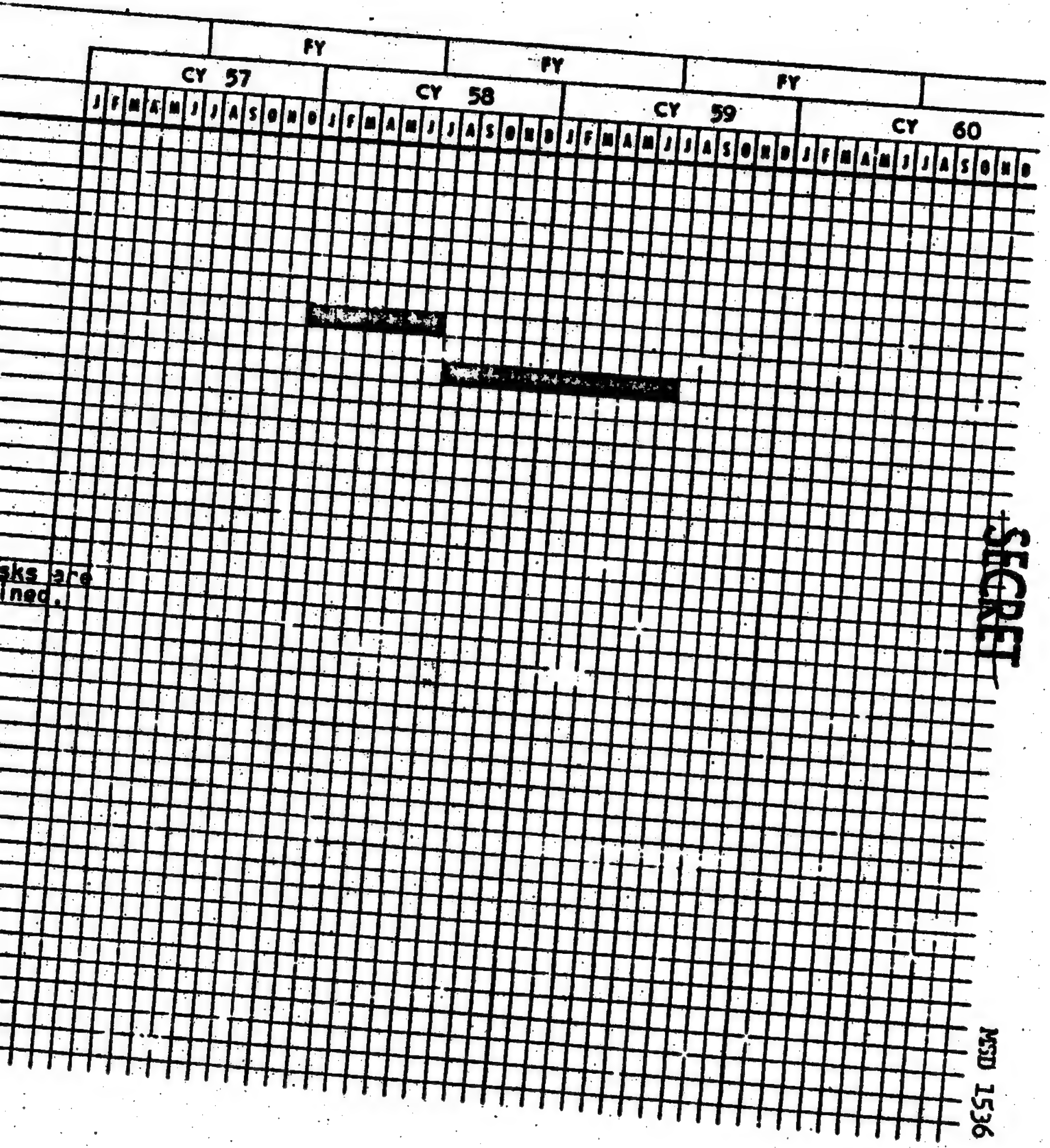
Tab 2 Summary - R & D Schedule
(Continued)

Task - Airborne Data Processing
Task - Data Recording
Task - Data Transmission

A. Laboratory Model

1. Fabrication

2. Performance and Environmental Testing



Note: The schedules for these tasks are similar and are being combined.

Task - Airborne Data Processing
Task - Data Recording
Task - Data Transmission
(Cont'd on next page)

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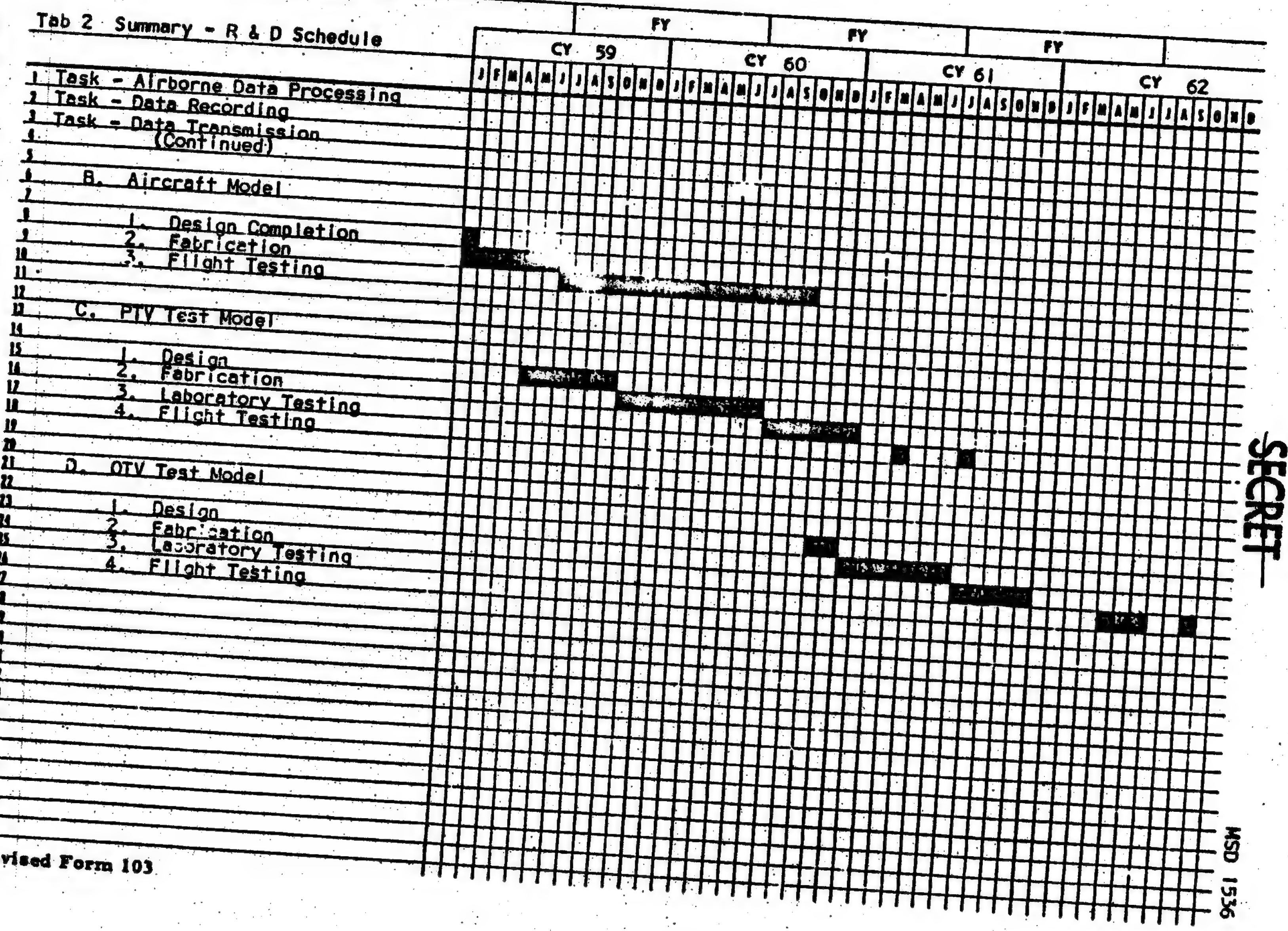
Subsystem G - INFRARED SUBSYSTEM

Tab 2 Summary - R & D Schedule



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Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule (Continued)

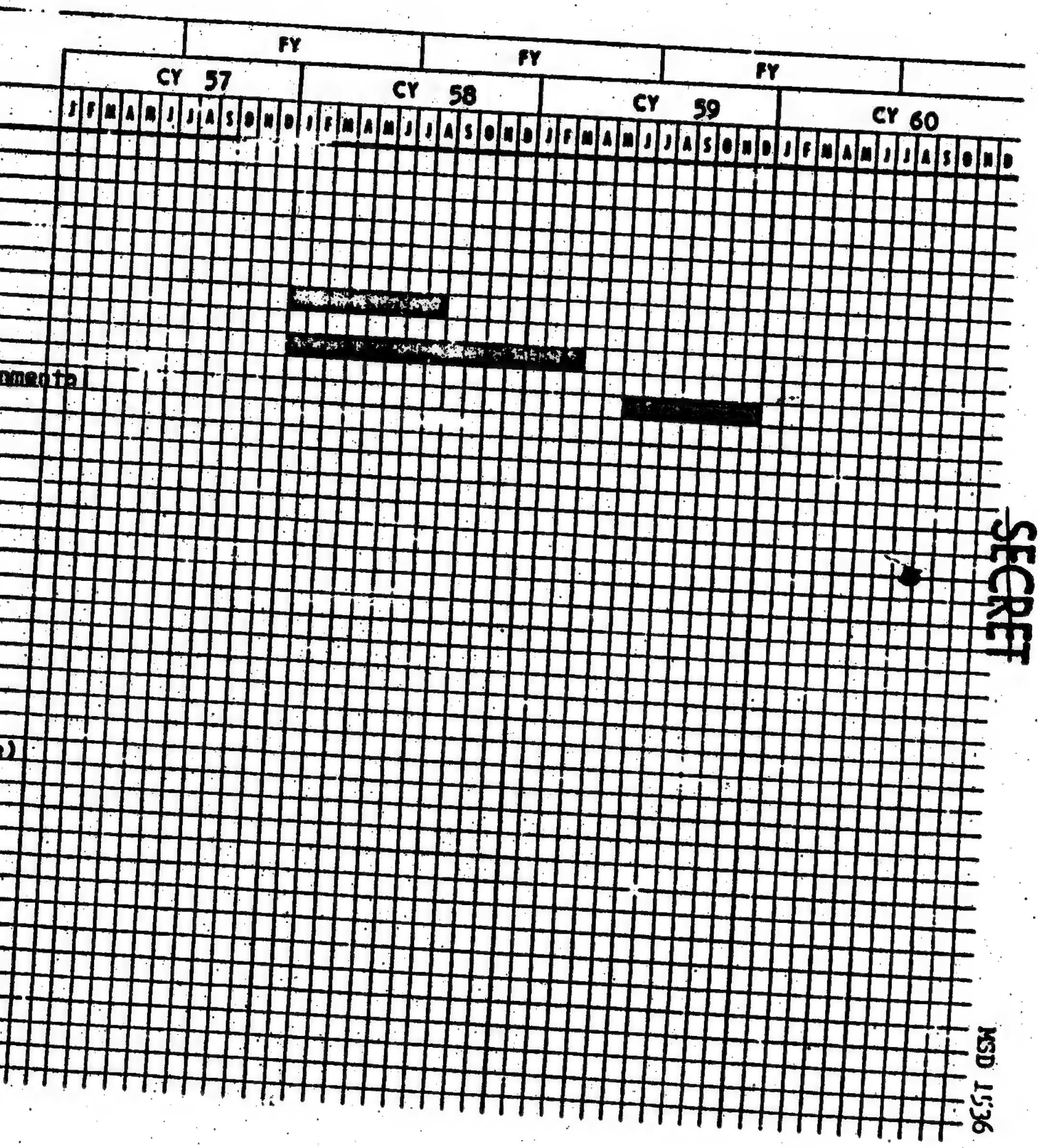
Task - Data Link Network for ICBM Tracking

A. Laboratory Model

1. Design

2. Fabrication

3. Performance and Environmental Testing



Task - Data Link Network for ICBM Tracking (Cont'd on next page)

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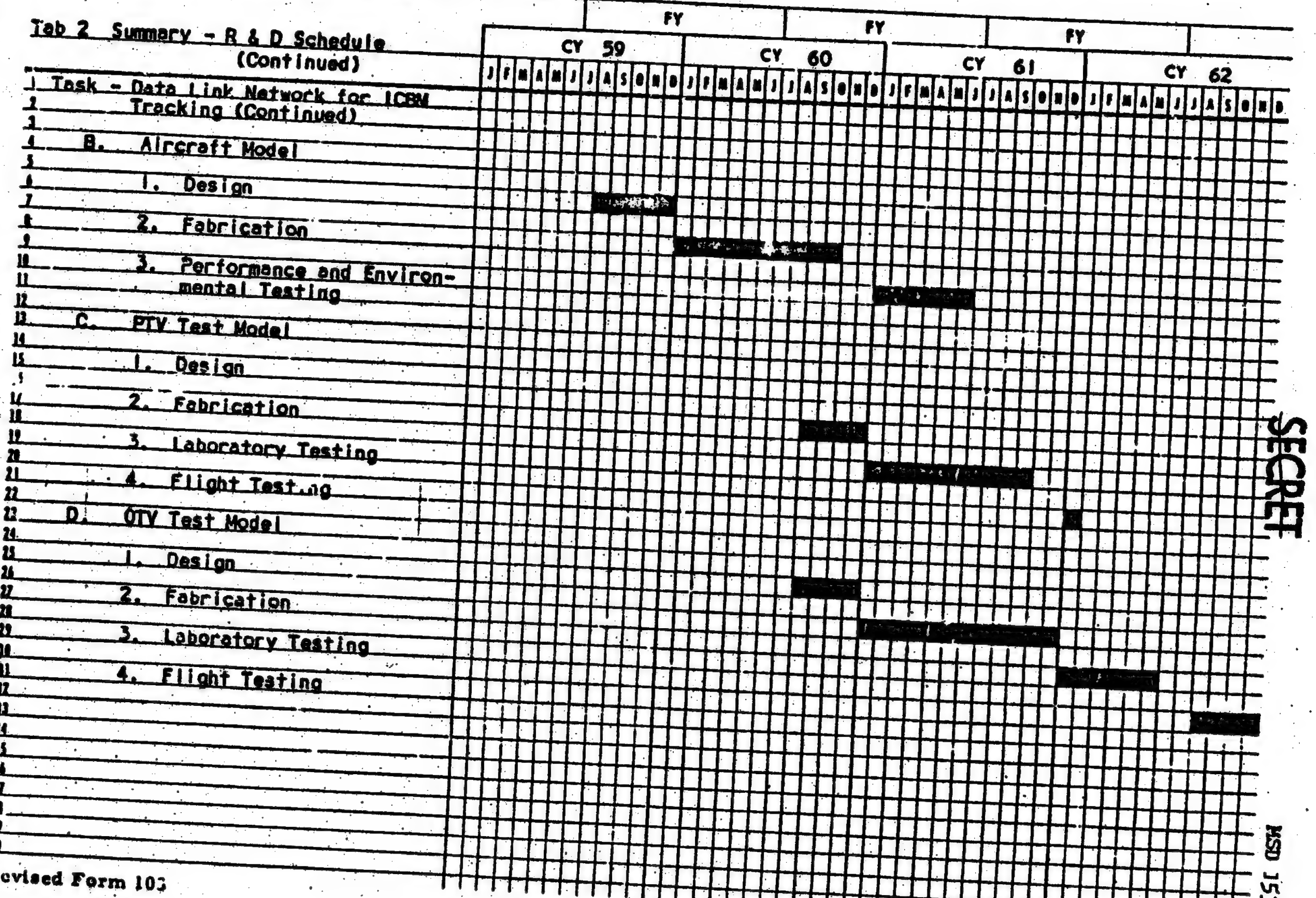
Subsystem G - INFRA RED SUBSYSTEM

Tab 2 Summary - R & D Schedule (Continued)



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1.

R & D TEST ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE 1 OF 4 PAGES

3. DATE 1 March 1956

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. RESP CENTER

8. PROJECT OFFICER

9. SUPPORTS (Sys or Proj)

10. CONTRACTOR

11. CONTR NR

12. PRIORITY AND PREC

13. SECURITY

14. ITEM NUMBER	15. TEST ITEM	16. TEST DESCRIPTION	17. TEST AGENCY AND SITE	18. TEST ITEM AVAILABLE	19. RDD TEST COMPL DATE
1	Experimental Laboratory IR Scanner	Laboratory Performance Tests	Eastman Kodak Co Rochester, N. Y.	June 1958	June 1959
2	Aircraft Test Model of IR Scanner	Flight Tests in Manned Aircraft	Eastman Kodak Co Rochester, N. Y.	Oct. 1959	Oct. 1960
3	IR Subsystem Environmental Components	First STV Flight Tests	AFMTC	July 1960	Aug. 1960
4	IR Subsystem Environmental Components	Second STV Flight Test	AFMTC	Oct. 1960	Nov. 1960
5	PTV Infrared Subsystem (Bomber Tracking)	First PTV Flight Test	AFMTC	Feb. 1961	Mar. 1961
6	IR Subsystem Environmental Components	Third STV Flight Test	AFMTC	Mar. 1961	Apr. 1961

TEST CENTER APPROVAL

20. NAME

ORGANIZATION

21. NAME

ORGANIZATION

DATE

RESPONSIBLE CENTER APPROVAL

22. NAME

ORGANIZATION

DATE

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1\.

R & D TEST ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE 2 OF 4 PAGES

3. DATE 1 March 1956

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. RESP CENTER

8. PROJECT OFFICER

9. SUPPORTS (Sys or Proj)

10. CONTRACTOR

11. CONTR NR

12. PRIORITY AND PREC

13. SECURITY

14. ITEM NUMB'R	15. TEST ITEM	16. TEST DESCRIPTION	17. TEST AGENCY AND SITE	18. TEST ITEM AVAILABLE	19. RQD TEST COMPL DATE
7	PTV Infrared Subsystem (Bomber Tracking)	2nd PTV Flight Test	AFMTC	July 1961	Aug. 1961
8	IR Subsystem Environmental Components	4th STV Flight Test	AFMTC	Sept. 1961	Oct. 1961
9	PTV Infrared Subsystem (ICBM Tracking)	3rd PTV Flight Test	AFMTC	Dec. 1961	Jan. 1962
10	IR Subsystem Environmental Components	5th STV Flight Test	AFMTC	Jan. 1962	Feb. 1962
11	OTV Infra Red Subsystem (Bomber Tracking)	1st OTV Flight Test	GFF *	April 1962	**

* To be determined at a later date.
** For useful life of vehicle and payload.

TEST CENTER APPROVAL

20. NAME ORGANIZATION

21. NAME ORGANIZATION DATE

DATE

RESPONSIBLE CENTER APPROVAL

22. NAME ORGANIZATION DATE

ARDC FORM 1 JUL 55 105 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

1.

R & D TEST ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE 3 OF 4 PAGES

3. DATE 1 March 195[illegible]

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. RESP CENTER

8. PROJECT OFFICER

9. SUPPORTS (Sys or Proj)

10. CONTRACTOR

11. CONTR NR

12. PRIORITY AND PREC

13. SECURITY

14. ITEM NUMBER	15. TEST ITEM	16. TEST DESCRIPTION	17. TEST AGENCY AND SITE	18. TEST ITEM AVAILABLE	19. RQD TEST COMPL DATE
12	OTV Infrared Subsystem (Bomber Tracking)	2nd OTV Flight Test	GFF *	May 1962	**
13	OTV Infrared Subsystem (Bomber Tracking)	3rd OTV Flight Test	GFF *	June 1962	**
14	OTV Infrared Subsystem (Bomber Tracking)	4th OTV Flight Test	GFF *	Aug. 1962	**
15	OTV Infrared Subsystem (ICBM Tracking)	5th OTV Flight Test	GFF *	Aug. 1962	**
16	OTV Infrared Subsystem (ICBM Tracking)	6th OTV Flight Test	GFF *	Sept. 1962	**

* To be determined at a later date.

** For useful life of vehicle and payload.

TEST CENTER APPROVAL

20. NAME ORGANIZATION

21. NAME ORGANIZATION DATE

RESPONSIBLE CENTER APPROVAL

22. NAME ORGANIZATION DATE

ARDC FORM 1 JUL 55 105 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

1.

R & D TEST ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE 4 OF 4 PAGES

3. DATE 1 March 1956

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. RESP CENTER

8. PROJECT OFFICER

9. SUPPORTS (Sys or Proj)

10. CONTRACTOR

11. CONTR NR

12. PRIORITY AND PREC

13. SECURITY

14. ITEM NUMBER	15. TEST ITEM	16. TEST DESCRIPTION	17. TEST AGENCY AND SITE	18. TEST ITEM AVAILABLE	19. RQD TEST COMPL DATE
17	OTV Infrared Subsystem (ICBM Tracking)	7th OTV Flight Test	GFF *	Oct. 1962	**
18	OTV Infrared Subsystem (ICBM Tracking)	8th OTV Flight Test	GFF *	Oct. 1962	**

* To be determined at a later date.
** For useful life of vehicle and payload.

TEST CENTER APPROVAL

20. NAME ORGANIZATION

21. NAME ORGANIZATION DATE

RESPONSIBLE CENTER APPROVAL

22. NAME ORGANIZATION DATE

ARDC FORM 1 JUL 55 105 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

~~SECRET~~

MSD 1536

1.

R & D TEST AND TEST SUPPORT AIRCRAFT ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE 1 OF 1 PAGES

3. DATE 1 March 1956

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. ITEM NUMBER	8. AIRCRAFT REQUIRED QTY	TYPE, MODEL AND SERIES	SERIAL NUMBER	9. ASG CODE	10. MOD REQD	11. DATE REQD AND LOCATION	12. ESTIMATED RELEASE DATE	13. RECOMMENDED DISPOSITION	14. F HRS F CST	15. EST COST

AIRCRAFT FOR INFRARED RECONNAISSANCE SUBSYSTEM WILL BE SAME AS REQUESTED FOR SUBSYSTEM H - VEHICLE ELECTRONICS

ARDC FORM 1 JUL 55 106 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

1\.

R & D MATERIEL ANNEX

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ OTHER

2. REPORTS CONTROL SYMBOL

PAGE | OF | PAGES

3. DATE 1 March 1956

4. TITLE Subsystem G - INFRARED RECONNAISSANCE

5. INITIAL ☒ CHANGE

6. NUMBER

7. MATERIEL REQUIREMENTS (Indicate Items in Columnar Form using Columns as cited in Examples)

1. Special material required at Eastman Kodak Co., Rochester, N. Y.		
Test Equipment	100,000	1957
Aircraft Ground Handling Equipment	GFE	1959
2. Special material required at AFMTC		
Test Equipment	50,000	1960
3. Special material required at new Test Site to be determined at later date		
Test Equipment	50,000	1962

ARDC FORM 1 JUL 55 107 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

SUBSYSTEM G - INFRARED RECONNAISSANCE

DATE 1 March 1956

ITEM: Rochester, New York, Airport
(Eastman Kodak Facilities)
AFMTC*
Alternate Launching Site*

USING AGENCY: Lockheed and Eastman

LOCATION: Rochester, New York

BUDGET CONTROL ESTIMATE:

NEED DATE: This facility currently exists.

SCHEDULE:

	1956						~~1957~~ 1958												~~1958~~ 1959												~~1959~~ 1960											
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	10				

DESCRIPTION AND UTILIZATION:

The Rochester facility will be utilized in carrying out the aircraft development flight tests on the infrared subsystem. Ground handling for the B-50 aircraft will be required.

REMARKS:

Specialized equipment will be needed. Facilities for handling and loading one B-50 aircraft at Rochester, N. Y. are required. This aircraft will be bailed equipment operated by Lockheed crews.

* Complete description of these facilities is given in Tab 6 of Subsystem L - Vehicle Ground Support.

Tab 7

R & D Contract Funds

Subsystem G - Infrared Reconnaissance

Subsystem G. INFRARED RECONNAISSANCE

Tab 7. R & D Contract Funds (in thousands of dollars)

	FY 57				FY 58				FY 59				FY 60	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
LAC														
(1) Research and Engineering	10	10	10	10	10	10	10	10	15	15	14	14	14	24
EASTMAN KODAK	22	40	67	67	74	74	79	84	124	124	124	124	163	188
CBS	36	51	67	83	105	121	138	139	144	162	162	160	167	204
Sub Total	68	102	145	161	190	206	228	233	284	301	301	301	346	418
Fee	6	10	14	16	19	20	22	23	28	30	30	30	34	43
TOTAL*	75	112	160	177	209	227	251	257	312	332	332	332	381	461
Total Fiscal Year				524				944				1308		

*Differences in totals due to rounding

Subsystem D. INFRARED RECONNAISSANCE

Tab 7. R & D Contract Funds (in thousands of dollars) (Cont'd)

	FY 60		FY 61				FY 62				FY 63				TOTALS
	15	16	17	18	19	20	21	22	23	24	25	26	27		
LAC															
(1) Research and Engineering	24	24	24	24	24	24	9	9	10	10	10	10	0		393
EASTMAN KODAK	203	228	182	182	172	172	88	88	96	30	0	0	0		2,827
CBS	234	259	289	289	302	272	252	237	252	304	319	324	274		5,366
Sub Total	463	513	497	497	500	470	350	335	372	365	329	334	274		8,583
Fee	46	51	49	49	50	47	35	33	35	36	32	33	27		858
TOTALS	510	565	547	547	550	517	386	369	395	402	363	368	308		9,441
Total Fiscal Year		1917				2161				1552			1033		9,439
*Difference in totals due to rounding															

Tab 8

Estimate of Manpower Requirements

Subsystem G - Infrared Reconnaissance

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Subsystem G. INFRARED RECONNAISSANCE

Tab 8. Estimate of Manpower Requirements

WORK ITEM	Type of Manpower	QUARTERS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
LAC Research and Engineering	1-2-3*	2	2	2	2	2	2	2	2	3	3	3	3	3	5
CBS Scientific and Engineering	1	2	3	4	5	6	7	8	8	8	9	9	9	9	10
CBS Engineering Support	2	4	6	8	10	12	14	16	16	16	18	18	18	18	20
CBS Manufacturing	4	1	1	1	1	1	1	1	1	1	1	1	1	2	6
Sub-Total		7	10	13	16	19	22	25	25	25	28	28	28	29	36
EK Scientific and Techn	1	2	4	4	4	4	4	4	4	6	6	6	6	6	6
EK Engineering Support	2	3	5	5	5	5	5	6	6	9	9	9	9	9	9
EK Shops and Production	4	0	0	5	5	5	5	5	5	8	8	8	8	16	21
EK Technical Field Service	1	0	0	1	1	1	1	1	2	2	2	2	2	2	2
Sub-Total		5	9	15	15	15	15	16	17	25	25	25	25	33	38
TOTAL		14	21	30	33	36	39	43	44	53	56	56	56	65	79
*Average															
40% Type 1 Scientific & Technical															
50% Type 2 Engineering Support															
10% Type 3 Management & Administration															

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Subsystem 6. INFRARED RECONNAISSANCE

Tab 8. Estimate of Manpower Requirements (Cont'd.)

WORK ITEM	Type of Manpower	15	16	17	18	19	20	21	22	23	24	25	26	27		TOTAL MAN QUARTERS
		QUARTERS														
LAC Research and Engineering [illegible]	1-2-3*	5	5	5	5	5	5	2	2	2	2	2	2			78
CSM Scientific and Engineering	1	10	10	10	10	11	11	11	11	11	12	12	12	12		240
CSM Engineering Support	2	20	20	20	20	22	22	22	22	22	24	24	24	24		482
CSM Manufacturing	4	12	17	23	23	22	17	12	9	12	19	22	23	13		244
Sub-Total		42	47	53	53	55	50	45	42	45	55	58	59	49		964
EK Scientific and Technical	1	6	6	6	6	6	5	3	3	4	2					113
EK Engineering Support	2	9	9	9	9	8	7	5	5	6	3					154
EK Shops and Production	4	24	29	21	21	20	20	12	12	12	6					2[illegible]6
EK Technical Field Service	1	2	2	2	2	2	2	1	1	1	1					35
Sub-Total		41	46	38	38	36	34	21	21	23	12					588
TOTAL		88	98	96	96	96	89	66	65	70	69	60	61	49		1630
*Average																
40% Type 1 Scientific & Technical																
50% Type 2 Engineering Support																
10% Type 3 Management & Administration																

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